Claims

What is claimed is:

1. A system for depositing films on a semiconductor wafer comprising:

a deposition chamber operable to deposit a film on the semiconductor wafer therein according to one or more process conditions;

an acoustic microbalance within the deposition chamber; and

a controller,

wherein the controller is configured to provide feedback control of the one or more process conditions based on data provided at least in part by the acoustic microbalance.

2. The system of claim 1, wherein the system is configured for a sequential batch operation and the controller controls the one or more process conditions for a batch based, at least in part, on data obtained from a preceding batch.

3. The system of claim 2, wherein the controller detects a deposition process endpoint based, at least in part, on data provided by the acoustic microbalance.

4. The system of claim 1, wherein the feedback control is over an active deposition process, wherein the one or more process conditions in the active process are selectively modified.

5. The system of claim 4, wherein the controller comprises a computer system component that encodes a probabilistic dependancy model relating a set of input variables that includes at least a measurement from the acoustic microbalance to one or more outputs that relate to an effect of modifying one or more process conditions.

6. The system of claim 1, wherein the acoustic microbalance is mounted on the semiconductor wafer.

7. The system of claim 1, wherein the acoustic microbalance is mounted on a control wafer.

8. The system of claim 1, wherein the acoustic microbalance comprises a surface acoustic wave device.

9. The system of claim 1, wherein the acoustic microbalance comprises a quartz crystal.

10. A system for depositing films on a semiconductor wafer comprising:

a deposition chamber operable to deposit a film on the semiconductor wafer therein according to one or more process conditions;

an acoustic microbalance having a cantilever within the deposition chamber; and

a controller,

wherein the controller is configured to detect an endpoint of a deposition process based on data provided at least in part by the acoustic microbalance, and

wherein the controller comprises a computer system component that encodes a model or database that accounts for a difference between an extent of deposition on the cantilever and an extent of deposition on the semiconductor wafer.

11. The system of claim 10, wherein the computer system component encodes a probabilistic dependancy model that the computer system employs in accounting for the difference between the extent of deposition on the cantilever and the extent of deposition on the semiconductor wafers.

12. The system of claim 10, wherein the controller is configured to provide feedback control based on data provided at least in part by the acoustic microbalance.

13. The system of claim 10, wherein the system is configured for a sequential batch operation and the controller controls one or more process conditions for a batch based, at least in part, on data obtained from a preceding batch.

14. The system of claim 10, wherein the controller is configured to exercise feedback control over one or more process conditions.

15. The system of claim 14, wherein the controller comprises a computer system component that encodes a probabilistic dependancy model relating a set of input variables that includes at least a measurement from the acoustic microbalance to one or more outputs that relate to an effect of modifying one or more process conditions.

16. The system of claim 10, wherein the acoustic microbalance is mounted on the semiconductor wafer.

17. The system of claim 10, wherein the acoustic microbalance is mounted on a control wafer.

18. The system of claim 10, wherein the acoustic microbalance comprises a surface acoustic wave device.

19. The system of claim 10, wherein the acoustic microbalance comprises a quartz crystal.

20. A method of depositing a film on a semiconductor wafer comprising:
placing the semiconductor wafer in a chamber;
initiating a deposition process within the chamber;

monitoring the deposition process with an acoustic microbalance; and

controlling the deposition process based at least in part on data obtained from the acoustic microbalance.

21. The method of claim 20, wherein controlling the deposition process comprises applying a probabilistic dependancy model to account for a difference between an extent of deposition on the cantilever and an extent of deposition on the semiconductor wafer.

22. The method of claim 20, wherein controlling the deposition process comprises applying a probabilistic dependency model relating a set of input variables that includes at least a measurement from the acoustic microbalance to one or more outputs that relate to an effect of modifying one or more process conditions.

23. The method of claim 20, further comprising forming the acoustic microbalance on the semiconductor wafer.

24. A method of depositing a film on a semiconductor wafer comprising:

placing the semiconductor wafer in a chamber;

initiating a deposition process within the chamber;

monitoring the deposition process with an acoustic microbalance; and

detecting an endpoint for the deposition process based at least in part on data obtained from the acoustic microbalance,

wherein detecting the process endpoint involves an application of a model or database that accounts for a difference between an extent of deposition on the cantilever and an extent of deposition on the semiconductor wafer.

25. The method of claim 24, wherein the model or database comprises a probabilistic dependancy model.

26. A method of developing a probabilistic dependancy model relating to a deposition process comprising:

obtaining a set of training data by repeatedly carrying out the deposition process with varying process conditions and taking measurements relating to the process including measurements from an acoustic microbalance and measurements relating to an outcome of the deposition process; and

training the model with the training data.

27. The method of claim 26, wherein the measurements relating to an outcome of the deposition process include measurements relating to an outcome other than film thickness.

28. The method of claim 26, wherein while repeated carrying out the deposition process, the process condition are varied systematically.

29. A method of depositing a film on a semiconductor wafer comprising:

placing the semiconductor wafer in a chamber;

initiating a deposition process within the chamber;

monitoring the deposition process with an acoustic microbalance; and

controlling the deposition process based at least in part on data obtained from the acoustic microbalance and a learning probabilistic model developed according to the method of claim 26.